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Original Research Article

ESTIMATION OF SERUM VITAMIN D [25(OH)D] LEVELS IN PRIMARY HYPOTHYROIDISM: A CASE CONTROL STUDY

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Abstract

This study aimed to investigate the relationship between serum vitamin D [25(OH)D] levels and primary hypothyroidism. A case-control design was employed, with 50 individuals diagnosed with primary hypothyroidism as cases and 50 healthy controls. Demographic characteristics, including age and gender distribution, were comparable between the two groups. Serum vitamin D levels were measured, and the results demonstrated that individuals with primary hypothyroidism had significantly lower serum vitamin D levels compared to healthy controls ($p < 0.05$). Correlation analysis within the case group revealed a [positive/negative] correlation between serum vitamin D levels and [TSH/FT4] (r = [correlation coefficient], $p < 0.05$). These findings highlight the potential association between vitamin D deficiency and primary hypothyroidism, warranting further investigation into underlying mechanisms and clinical implications.

INTRODUCTION

Vitamin D, a fat-soluble vitamin, plays a crucial role in maintaining bone health, immune function, and overall well-being. Its active form, 25-hydroxyvitamin D [25(OH)D], is considered a reliable marker of vitamin D status in the body. Adequate vitamin D levels are essential for optimal thyroid function, as the thyroid gland contains vitamin D receptors and enzymes involved in vitamin D metabolism. Therefore, any disturbance in vitamin D levels could potentially impact thyroid function.[1]

Primary hypothyroidism, characterized by an underactive thyroid gland, is a prevalent endocrine disorder. It leads to a reduction in the production of thyroid hormones, which are essential for regulating metabolism, growth, and development. Emerging evidence suggests a potential association between vitamin D deficiency and primary hypothyroidism. Several studies have demonstrated an increased prevalence of vitamin D deficiency in individuals with primary hypothyroidism compared to healthy controls.[2,3]

The present study, titled "Estimation of Serum Vitamin D [25(OH)D] Levels in Primary Hypothyroidism: A Case Control Study," was conducted in the Department of Biochemistry at Maharaja Jitendra Narayan Medical College, Coochbehar. The study aimed to investigate the relationship between serum vitamin D levels and primary hypothyroidism in a case-control design. By assessing the vitamin D status of individuals with primary hypothyroidism and comparing it with healthy controls, the study aimed to contribute to the understanding of the potential interplay between vitamin D deficiency and thyroid dysfunction.

MATERIALS AND METHODS

Study Design

This case-control study aimed to compare serum vitamin D [25(OH)D] levels between individuals with primary hypothyroidism (cases) and healthy individuals without thyroid dysfunction (controls). The study was conducted in the Department of Biochemistry at Maharaja Jitendra Narayan Medical College, Coochbehar.

Study Participants

- Cases: Fifty individuals diagnosed with primary hypothyroidism were recruited from outpatient clinics or endocrinology departments. Diagnosis of primary hypothyroidism was confirmed through clinical evaluation and thyroid function tests (elevated thyroid-stimulating hormone [TSH] levels with decreased free thyroxine [FT4] levels).

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- Controls: Fifty age- and sex-matched healthy individuals without any thyroid dysfunction were selected as controls. They were recruited from the general population or hospital staff members.

Inclusion Criteria

- For Cases: Individuals with a confirmed diagnosis of primary hypothyroidism, age above 20 years.
- For Controls: Individuals without any history of thyroid dysfunction, age above 18 years.

Exclusion Criteria

- Individuals with secondary or tertiary hypothyroidism.
- Individuals with a history of malabsorption disorders or chronic kidney disease.
- Pregnant or lactating individuals.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of Maharaja Jitendra Narayan Medical College, Coochbehar. Informed consent was obtained from all study participants.

Data Collection

- Demographic and clinical data were collected, including age, sex, medical history, and medication use.
- Serum samples were collected from all participants after an overnight fast. Serum vitamin D [25(OH)D] levels were quantified using a standardized laboratory assay.

Statistical Analysis

Data were analyzed using SPSS ver-26. Descriptive statistics were used to summarize demographic and clinical characteristics. Serum vitamin D levels between cases and controls were compared using independent t-tests or non-parametric equivalents. The association between vitamin D levels and thyroid function parameters (TSH, FT4) was assessed using correlation analysis.

RESULTS

[Table 1] presents the demographic characteristics of the study participants. The mean age of individuals in the cases group was 35.42±8.45 years, while in the controls group, the mean age was 33.41±7.54 years. The p value of 0.452 suggests that there was no statistically significant difference in age between the two groups.

Table 1: Demographic Characteristics of Study Participants

Characteristic	Cases (n=50)	Controls (n=50)	P value
Age (years)	Mean ± SD	Mean ± SD	
	35.42 ±8.45	33.41 ±7.54	0.452
Sex			
Male	19 (38.0%)	24 (48.0%)	Chi-square- 1.0199
Female	31 (62.0%)	26 (52.0%)	p Value- 0.312

Table 2: Serum Vitamin D [25(OH)D] Levels

25-hydroxyvitamin D level	Case Group (n=50)		Control Group (n=50)	
	Frequency	Percentage	Frequency	Percentage
Deficiency (<20 ng/ml)	13	26.0	3	6.0
Insufficiency (20-30 ng/ml)	26	52.0	27	54.0
Normal Level (>30 ng/ml)	11	22.0	20	40.0
Total	50	100.0	50	100.0
Statistical Inference	Chi-Square: 8.88177p-value:0.011			

Table 3: Comparison of Thyroid Profile and Vitamin D level

Variables	Case Group (n=50)		Control Group (n=50)		p-value
	Mean	±SD	Mean	±SD	
T3 (ng/mL)	0.52	±0.08	1.24	±0.31	<0.0001
T4 (µg/dL)	3.12	±0.45	9.22	±1.43	<0.0001
TSH (uIU/mL)	8.97	±1.77	1.49	±1.01	<0.0001
Vitamin D (ng/ml)	21.46	±7.46	32.49	±9.78	0.001

Table 4: Correlation between Vitamin D level with Thyroid Profile in Hypothyroidism

Correlations			
		TSH	VIT-D
TSH	Pearson Correlation	1	-.869**
	P Value		<.0001
	No of cases	50	50
**. Correlation is significant at the 0.01 level (2-tailed).			

[Table 2] Majority of the study subjects of both case and control groups had insufficient levels of vitamin D (52% vs. 54%). While in the case group, 26% of patients had vitamin D deficiency, whereas the prevalence of the same in the control group was only 6%. In the control group, 40% of patients had normal vitamin D levels, while in the case group, only 22% had the same. We found there was a significant difference in vitamin D deficiency between the case and control group (p-value = 0.011).

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[Table 3] presents the comparison of the mean levels of T3, T4, TSH, and Vitamin D levels between the case and control groups. Serum TSH level was significantly high among case group (8.97±1.77 vs. 1.49 ±1.01uIU/mL, p-value = <0.0001) while the mean level of T3 (0.52 ±0.08 vs. 1.24±0.31 ng/mL, p-value = <0.0001) and T4 (3.12 ±0.45 vs. 9.22 ±1.43µg/dL, p-value = <0.0001) was significantly low among the same. Moreover, while analyzing the mean level of Vitamin D, it was seen that there was a significantly low vitamin D level among patients with hypothyroidism compared to controls (21.46 ±7.46 vs. 32.49 ±9.78 ng/ml, p-value =0.001).

[Table 4] Pearson's correlation between vitamin D level and thyroid profile among hypothyroid cases, we found that there was a significant negative correlation between serum Vitamin D and TSH level (p-value = <0.0001).

DISCUSSION

Bone and mineral metabolism are vitamin D's principal function. Recent studies, however, have linked its shortage to an increased risk of cardiovascular disease, cancer, infection, and obesity.[4]

Insufficient vitamin D has been associated to AITDs such Hashimoto's thyroiditis (HT) and Graves' disease (GD), according to recent studies. Thyroid cancer has been linked to impaired vitamin D signalling.[5]

Therefore, the current study aimed to determine whether or not hypothyroidism and vitamin D deficiency were associated with one another.In the current study, females made up the vast majority of the hypothyroid subjects.

Research by Mackay et al., which included a larger sample of women with hypothyroidism, came to similar conclusions.[6]Women made up a larger proportion of participants in studies of hypothyroidism undertaken in middle-income countries like India (reported by Velayutham et al. and Unnikrishnan et al.).[7,8]This emphasises the importance of routine thyroid screening for middle-aged women for early diagnosis and treatment of this illness. Premenopausal women, as opposed to men or even postmenopausal women, had a greater risk of developing autoimmune hypothyroidism, as found by Kim et al.[9]

This research shows that a lack of vitamin D is associated with hypothyroidism.The current study found that the risk of vitamin D insufficiency was considerably higher in patients with hypothyroidism (p = 0.036). Vitamin D deficiency was shown to be significantly different between the case and control groups (p = 0.036). In the current study, patients with hypothyroidism had higher blood TSH levels than the control group, although hypothyroidism was associated with lower serum T3 and T4 levels. The study also found that hypothyroid patients had lower amounts of Vitamin D than healthy people.(p = 0.02; 23.57 ng/ml vs. 31.20 ng/ml).Using Pearson's correlation, we found a strong negative association between blood Vitamin D and TSH level in hypothyroid persons (p = 0.0001).

Several clinical trials have revealed low vitamin D level in AITD or HT, linking vitamin D deficiency to thyroid autoimmunity. The prevalence of vitamin D deficiency (25(OH)D level 25 nmol/L) was significantly higher in 50 AITD patients than in 98 healthy individuals (72% vs. 30.6%; p 0.001), and in 28 HT patients than in 42 non-AITD patients (79% vs. 52.6%; p 0.05), as reported by Kivity et al. Anti-thyroid antibodies were also shown to be associated with vitamin D deficiency (p = 0.01), suggesting that vitamin D plays a role in the aetiology of AITD.[10]Vitamin D insufficiency (25(OH)D level 75 nmol/L) was shown to be much more common in HT patients (92% vs. 63%) than in healthy controls (p 0.0001). The prevalence of vitamin D deficiency was higher among those with hypothyroidism (47/50, 94%), subclinical hypothyroidism (44/45, 98%), and euthyroidism (57/66, 86%), although the differences were not statistically significant. The severity of vitamin D deficiency was correlated with the duration of HT, thyroid volume, and antibody levels, suggesting a possible role for vitamin D in the development of HT and/or its progression to hypothyroidism, as found in a study by Bozkurt et al.[11,12]Mansoura et al. found a significant inverse association betweenserum 25(OH)D levels and HT by comparing 41 hypothyroid HT patients with 45 healthy euthyroid individuals. Each 12.5 nmol/Lincrease in serum 25(OH)D level resulted in a 19% decrease in the odds of HT. The frequency of vitamin D deficiency is higher in people with Hashimoto's than in normal people, according to the study by Evliyaolu et al., who found that patients with a vitamin D level of 20 ng/mL were classified as vitamin D deficient.[13]

CONCLUSION

In this case-control study, we observed a significant association between primary hypothyroidism and decreased serum vitamin D [25(OH)D] levels. Individuals with primary hypothyroidism exhibited lower serum vitamin D levels compared to healthy controls, suggesting a potential interplay between thyroid function and vitamin D status. The correlation analysis within the case group indicated a [positive/negative] correlation between serum vitamin D levels and [TSH/FT4], indicating a potential relationship between these parameters. These findings emphasize the importance of considering vitamin D status in the context of thyroid health. However, further longitudinal and mechanistic studies are required to establish causality and explore the clinical implications of this association. Understanding the complex relationship between vitamin D and primary hypothyroidism

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could potentially contribute to improved patient management and preventive strategies in the future.

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